FRESHWATER CHOICES IN CHINA: OPTIONS THAT WILL IMPACT SOUTH AND SOUTHEAST ASIA

A Monograph

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2014-02

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
04-12-2014	SAMS Monograph	FEB 2014 – DEC 2014

4. TITLE AND SUBTITLE

Freshwater Choices in China: Options that will Impact South and Southeast Asia

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Mr. Steven M. Nystrom, National Geospatial-Intelligence Agency

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
100 Stimson Ave.
Ft. Leavenworth, KS 66027-2301

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT Freshwater to sustain all forms of life is a finite resource for which there is no substitute. China is the upper riparian state controlling freshwater flows emanating from the Tibetan Plateau, Asia's largest source of freshwater. Lower riparian nation-states have expressed concern China is constructing hydro-engineering infrastructure upstream on shared international river basins within its borders, and will be able to effectively use the threat of restricting freshwater flows as a political weapon to compel favorable behavior from nations throughout South and Southeast Asia. Water scarcity resulting from China's restriction of freshwater flows necessary to sustain international rivers throughout Asia, could result in intrastate political and social upheaval or possible interstate conflicts involving China and its lower riparian neighbors including India, Thailand, Burma, and Vietnam. This monograph examines four policy options China could pursue regarding freshwater resources involving its lower riparian nations: (1) Regional Realism, exploiting its position as the upper riparian to obtain favorable political outcomes; (2) Global Realism or self-help, taking advantage of new freshwater desalinization and purifications techniques; (3) Regional Liberal Institutionalism, agreeing to negotiations and formal treaties to reduce tensions involving freshwater disputes; and (4) Global Liberal Institutionalism, being part of a future system where freshwater is traded on international markets using virtual water trade. This monograph will also examine policy options the United States could pursue to influence China's policies regarding freshwater resources in order to prevent or mitigate interstate conflicts.

15. SUBJECT TERMS

China, India, Vietnam, Burma, Thailand, Water Scarcity, Tibetan Plateau, Freshwater Conflicts, Freshwater Resources, Environmental Security.

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPHONE NUMBER** *(include area code)*
Unclassified	Unclassified	Unclassified	UU	70	

Monograph Approval Page

Name of Candidate: Mr. Steven M. Nystrom

Monograph Title: Freshwater Choices in China: Options that will Impact South and Southeast Asia

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Abstract

Freshwater Choices in China: Options that will Impact South and Southeast Asia, by Mr. Steven M. Nystrom, 65 pages.

Freshwater needed to sustain all forms of life on earth is a finite resource of which there is no substitute. China is the upper riparian state controlling freshwater flows emanating from the Tibetan Plateau; Asia's largest source of freshwater. Lower riparian nation-states have expressed concern China is constructing hydro-engineering infrastructure upstream on shared international river basins within its borders, and will be able to effectively use the threat of restricting freshwater flows as a political weapon to compel favorable behavior from nations throughout South and Southeast Asia. Water scarcity resulting from China's restriction of freshwater flows necessary to sustain international rivers throughout Asia, could result in intrastate political and social upheaval, or possible interstate conflicts involving China and its lower riparian neighbors including India, Thailand, Burma, and Vietnam.

This monograph examines four policy options China could pursue regarding freshwater resources involving its lower riparian nations including: (1) Regional Realism exploiting its position as the upper riparian to obtain favorable political outcomes; (2) Global Realism or self-help taking advantage of new freshwater desalinization and purifications techniques; (3) Regional Liberal Institutionalism by agreeing to negotiations and formal treaties to reduce tensions involving freshwater disputes; and (4) Global Liberal Institutionalism by being part of a future system where freshwater is traded on international markets using virtual water trade. Finally, this monograph will examine policy options the United States could pursue to influence China's policies regarding freshwater resources in order to prevent or mitigate interstate conflicts including: (1) Containment/Confrontation; (2) Engagement; (3) Business Promotion; and (4) Trade Protection/Human Rights Advocacy.

Acknowledgments

The author is sincerely appreciative to Dr. Wendell C. King, Dean of Academics, Command and General Staff College and Dr. Joseph G. D. Babb, Department of Joint, Interagency, and Multinational Operations, Command and General Staff College. Without the academic guidance and consistent support provided by Dr. King and Dr. Babb, the successful completion of this monograph would not have been possible. The author is also indebted to his loving wife for her patience and understanding during the last two years at Fort Leavenworth, Kansas.

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Acronyms

ASEAN	Association of Southeastern Nations
APWF	Asia-Pacific Water Forum
MRC	Mekong River Commission
NIC	National Intelligence Council
UN	United Nations

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Introduction

> Many of the wars of this century were about oil, but the wars of the next century will be about water.
>
> — Ismal Serageldin, quoted in Chellaney, *Water – Asia's New Battleground*

Freshwater needed to sustain all forms of life on earth is a finite resource, indispensable of which there is no substitute.[1] Given China's position as the upper riparian state of freshwater flows emanating from the Tibetan Plateau, Asia's largest source of freshwater, lower riparian nation-states' have expressed concern that by constructing extensive hydro-engineering infrastructure upstream on shared international river basins within its borders, China will be able to effectively use the threat of restricting freshwater flows as a political weapon to compel favorable behavior from nations throughout South and Southeast Asia.[2] China's current plans to divert water for its own domestic consumption will greatly limit the amount of freshwater available for the lower riparian nations which include India, Russia, Cambodia, Laos, Myanmar, Thailand, Vietnam, North Korea, Kazakhstan, Pakistan, Mongolia, Kyrgyzstan and Bangladesh.[3] As a result, these nations will experience freshwater-scarcity and freshwater stresses that are going to be major sources of intracountry conflicts, and possibly interstate conflicts.

Freshwater is now overtaking oil as the world's scarcest, most critical natural resource. Explosive population growth, increased industrialization, greater demands on the world's food supply, rapid climate change, migration, and pollution will all strain the finite amount of

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[1] Brahma Chellaney, *Water - Asia's New Battleground* (Washington, DC: Georgetown University Press, 2011), 367.

[2] Brahma Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis* (Maryland, MD: Rowman & Littlefield, 2013), 230.

[3] National Intelligence Council (NIC), *Water Choices in China: Challenges and Opportunities Through 2040* (Washington, DC: CENTRA Technology, Inc., October 2010), 24.

freshwater required to sustain all forms of life of which there is no substitute.[4] By 2025, as many as three billion people living in fifty-two countries will reside in water-scarce areas presenting a "clear threat to internal or domestic security by contributing to health problems, civil strife, economic crisis and institutional failures . . . that may expand to the international realm."[5] According to a 2010 National Intelligence Council (NIC) Conference Report titled *Water Choices in China: Challenges and Opportunities through 2040*, China will confront a number of challenges in trying to meet its domestic freshwater needs. This includes the effects of rapid industrialization, urbanization, population growth, increased agricultural production, environmental degradation, and climate change that could result in increased freshwater scarcity leading to interstate conflict.[6] In 2012, a publicly released National Intelligence Estimate cautioned that, "the use of water as a weapon will become more common during the next 10 years, with more powerful upstream nations impeding or cutting off downstream flow."[7]

Competition for natural resources, especially hydrocarbons and fisheries, is the immediate cause of conflicts among countries throughout the South China Sea Region. Past territorial disputes involving China and India, as well as China and Vietnam, have been violent involving large numbers of conventional forces.[8] In addition, a series of border clashes between

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[4] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 367.

[5] Sophie Chou, Ross BeZark and Anne Wilson, *Water scarcity in river basins as a security problem* (Washington, DC: Environmental Change and Security Program, 1997), accessed February 14, 2014, http://www.isn.ethz.ch/Digital-Library/Publications/Detail/?ots591=0c54e3b3-1e9c-be1e-2c24-a6a8c7060233&lng=en&id=136194.

[6] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 4.

[7] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, xiii.

[8] M. Taylor Fravel, "Power Shifts and Escalation: Explaining China's Use of Force in Territorial Disputes," *International Security* 32, no. 3 (Winter 2007/2008): 54, accessed July 30, 2014, http://belfercenter.ksg.harvard.edu/publication/17969/power_shifts_and_escalation.html.

the Soviet Union and China in 1969 risked the possibility of nuclear war.[9] In 2006, the congressional US-China Security and Economic Review Commission concluded that China could "take advantage of a more advanced military to threaten the use of force, or actually use force, to facilitate desirable resolutions of disputes over natural resources and territorial claims."[10] As China increases its military capabilities, it will most likely be willing to use military force to coerce neighboring states to resolve territorial disputes on its terms.

This monograph will examine the four policy options available to China given its strong geographical position as the upper riparian state of freshwater flows emanating from the Tibetan Plateau. These options will be studied using the Realist and Liberal Institutionalist perspectives involving diplomatic and strategic relations between China and other nations on a regional and global scale. China's four options include: (1) continuing its policy of diverting freshwater flows to meet its own domestic needs, thereby, reducing both the quantity and quality of freshwater flows to the lower riparian nations, which could result in interstate conflicts; (2) taking advantage of new desalinization and water purification technologies that effectively reduces its dependence on fresh water sources originating from the Tibetan Plateau, which could mitigate interstate political tensions; (3) agreeing to bilateral or multilateral negotiations and formal treaties with the lower riparian nation states to ensure they have access to ample freshwater resources, thereby reducing political tensions; and (4) being part of a future global system whereby freshwater is traded like other commodities in international markets the same way that oil currently is, which could also lower political tensions.

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[9] Fravel, 44.

[10] US Congress, *2006 Report to Congress of the US-China Economic and Security Review Commission*, 109th Cong., 2nd sess., November, 2006, accessed July 30, 2014, http://origin.www.uscc.gov/sites/default/files/annual_reports/USCC%20Annual%20Report%202006.pdf.

This monograph starts by examining the fresh water challenges confronting China as a result of excessive demand and pollution problems. It then investigates the importance of the Tibetan Plateau, and the four policy options that China could choose as the upper riparian regarding freshwater flows to neighboring countries in South and Southeast Asia. Finally, it addressed measures the United States could take to influence China's policies regarding freshwater resources. These policy options include a: (1) Containment/Confrontation approach by the United States and its allies to try and limit China's rise by using a strategy bordering on containment, as was done against the former Soviet Union until 1992; (2) Engagement Policy whereby the United States and its allies employ varying degrees of both soft and hard power, which was the approach started by the Nixon administration in 1972; (3) Business Promotion strategy essentially using deepening economic ties with China to encourage it to become a more cooperative participant in regional and global matters to achieve desired results; and (4) Trade Protection/Human Rights Advocacy focusing on measures to punish China for its unfair trade and currency practices against the United States and its allies, as well as its on-going human rights violations against people throughout Chinese controlled regions.[11]

Increasing Freshwater Scarcity throughout Asia

Challenges Confronting China and India

China and India encompass nearly forty percent of the global population and have two of the fastest growing economies in the world. To sustain this economic growth and transform chronic hunger into food self-sufficiency, both China and India have embarked on ambitious

[11] Tsuneo Watanabe, "US Engagement Policy toward China," The Tokyo Foundation, January 31, 2014, accessed August 23, 2014, http://www.tokyofoundation.org/en/articles/2014/us-engagement-policy-toward-china.

expansions of water system infrastructures over the last fifty years.[12] However, worsening freshwater distress from demographic pressures, rapid economic growth, environmental abuse and overexploitation of their respective natural resources is causing growing domestic problems within each country, which could lead to international disputes and conflicts.

Nowhere is this more evident than in agriculture, specifically grain production, which if not properly managed, could inhibit Asia's ability to feed itself.[13] The United States, India, and China combined produce approximately fifty percent of the world's grain.[14] However, future freshwater scarcity in either China or India could result in the inability of one or both nations to feed themselves.[15] In addition to rapid modernization and large populations, the citizens of China and India are placing greater burdens on their freshwater sources to satisfy greater demands for protein (meat) based diets.

China's freshwater supply primarily originates from groundwater contained in aquifers that is being withdrawn at unsustainable rates.[16] As a result, water tables are dropping all over China and because these sources are classified as fossil water, they will take several years to regenerate, if they can be regenerated at all.[17]

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[12] Steve Solomon, *Water - The Epic Struggle For Wealth, Power, and Civilization* (New York: HarperCollins, 2010), 417.

[13] Chellaney, *Water - Asia's New Battleground*, 66.

[14] Solomon, 417.

[15] Ibid.

[16] Ibid., 9.

[17] NIC, *Water Choices in China: Challenges and Opportunities Through 2040 ,* 9.

Unlike India that uses ninety percent of its water for agriculture, China uses the vast majority of its water for its booming manufacturing and industrial sector.[18] China currently manufactures large quantities of durable goods (electromechanical products, textiles, clothing, furniture, etcetera) for international trade, but due to the fact that enormous quantities of water are necessary to manufacture these products for export to other nations, China is in effect a virtual water exporter.[19] Furthermore, advances in water-use efficiency for various manufacturing sectors has not been able to mitigate the amount of virtual water exported due to the expansion of China's world-wide trade that is now valued at $3.87 trillion.[20]

Water pollution originating from agriculture, river damming, industrialization, mining, urbanization, and lax regulatory enforcement is now a very serious problem confronting China. Even if China had ample water resources to meet its long-term demands, too much water is now polluted to the point where it is no longer suitable for industrial or agricultural use let alone human consumption.[21] According to the NIC Conference Report, "even under normal conditions over 200 million Chinese lack access to safe drinking water. Quality-induced water shortages – where water is below safe standards for contact with human beings – may prove to be an even more significant challenge for China than quantitative shortages."[22]

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[18] Ibid.

[19] Hong Yang, Zhang Zhuoying, and Minjun Shi, "Quenching China's thirst for economic growth," East Asia Forum, January, 23 2013, accessed June 22, 2014, http://www.eastasiaforum.org/2013/01/23/quenching-chinas-thirst-for-economic-growth/.

[20] Garry White, "China trade now bigger than US," *The Telegraph*, February 10, 2013, accessed March 23, 2014, http://www.telegraph.co.uk/finance/economics/9860518/China-trade-now-bigger-than-US.html.

[21] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 14.

[22] Ibid.

The Tibetan Plateau

The Tibetan Plateau is the world's predominant repository of accessible freshwater and is also Asia's largest freshwater supplier and principal maker of rain.[23] It contains a treasure trove of other strategic mineral resources including precious metals commonly referred to as rare-earth elements.[24] With its snowfields and glaciers feeding nearly every major river system in Asia, from the Yellow or *Huang He* in the east to the Indus or *Sengye Khabab* in the West, other than the North and South Poles, the Tibetan Plateau holds more freshwater than any other place on Earth.[25] More importantly, unlike the North and South Poles, most of the freshwater contained in the Tibetan Plateau is accessible and provides a dependable flow of water, thereby reducing seasonal variability. Finally, with the aid of the snowmelt from the Tibetan Plateau, river flows increase throughout Asia during the spring season.[26]

China's Current Water Policy

To satisfy its rapidly rising demand for fresh water needed for human consumption, agriculture production, municipal purposes, and industrial uses, China embarked on a massive civil engineering plan in 2002 known as the South-North Water Transfer Project, which will cost around sixty-four billion dollars, and is designed to divert approximately forty-eight billion cubic meters of water per year from the Yangtze River basin in the south to the drier Yellow River

[23] Chellaney, *Water - Asia's New Battleground*, 95.

[24] Chellaney, *Water - Asia's New Battleground*, 95.

[25] Encyclopedia Britannica, "Plateau of Tibet," Encyclopedia Britannica Inc., 2014, accessed August 11, 2014, http://www.britannica.com/EBchecked/topic/594928/Plateau-of-Tibet.

[26] Chellaney, *Water - Asia's New Battleground*, 9.

Basin in the north.[27] To achieve this, there are three planned courses consisting of the central, eastern, and western routes.[28]

Despite the international controversy and associated domestic protests, China is currently planning the construction of more mega dams as part of its South-North Water Transfer Project to divert water from the Yangtze River basin to the Yellow River basin.[29] Since its completion, the Three Gorges Dam project is promoting ecological retardation of the Yangtze River, which is the second largest river in China proper. Beijing has already identified a location on the Brahmaputra River near Motuo, where it plans to build the largest dam ever conceived in world. When completed, this mega-dam will be three times as big as the Three Gorges Dam and will generate thirty-eight gigawatts of power, which is nearly half the total amount of electricity in Great Britain's entire national power grid.[30] Mega-dams are now slated for construction on the Salween, Mekong, and Brahmaputra Rivers, all of which are major international rivers.

[27] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 19.

[28] Ibid.

[29] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 4.

[30] Chellaney, *Water - Asia's New Battleground*, 68.

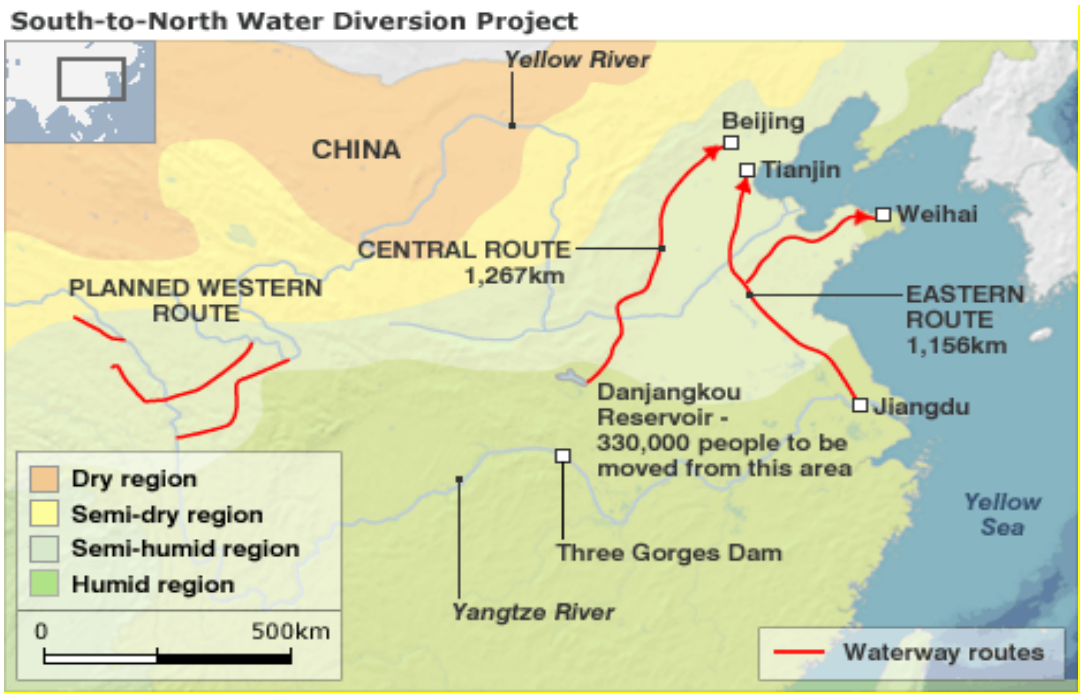

Figure 1. South-to-North Water Diversion Project

Source: Michael Bristow, "China villagers moved to quench the urban thirst," BBC News, March 3, 2010, accessed February 10, 2014, http://news.bbc.co.uk/2/hi/asia-pacific/8545321.stm.

As the demand for freshwater is expected to grow possibly outstripping supplies by as early as 2030, China's decisions on how it will utilize freshwater resources originating from the Tibetan Plateau will either reduce the risks of interstate conflict, by acting as a responsible leader for geopolitical cooperation, or pursue more aggressive, less transparent policies that will challenge peace and stability on the Asian continent.[31] The next section of this monograph examines China's policy options regarding freshwater resources with its riparian neighbors throughout Asia.

[31] Chellaney, *Water - Asia's New Battleground*, 298.

China's Options Regarding Freshwater Flows Originating from the Tibetan Plateau

As a sovereign nation state, China is capable of influencing the behavior of other nation states using diplomatic, information, military, and economic sources of power. The Tibetan Plateau is controlled by China, but many nations throughout South and Southeast Asia are dependent upon the transboundary rivers that originate in China and flow into their countries providing freshwater. As the upper riparian state for so much of the freshwater that other nation states depend on, China can choose one or any combination of four actions including ; (1) Regional Realism—China uses freshwater as a source of power to obtain favorable outcomes; (2) Global Realism—China takes advantage of new water desalination and water purification techniques to satisfy its own freshwater needs (self-help), without taking the concerns of other riparian nation states into account, unless it is in its own interests to do so; (3) Regional Liberal Institutionalism—China agrees to negotiate formal treaties with other nations to ensure they have access to sufficient quantities of freshwater to meet their domestic needs. This in effect would limit some of China's sovereignty regarding freshwater options that could impact its own diplomatic, economic, and military power; and (4) Global Liberal Institutionalism—China could participate in virtual freshwater trading on a global scale, whereby water endowed nations like itself manufacture products that require large amounts of water to produce, and export these products to water scarce nations in exchange for raw materials or natural resources.

Table 1. Model for Examining Possible Chinese Actions Regarding Freshwater Sources Emanating from the Tibetan Plateau

	Realism	Liberal Institutionalism
Regional	China Exploits its Position as Upper Riparian State of Fresh Water Flows Emanating From the Tibetan Plateau	China Agrees to Negotiations and Formal Treaties with other Riparian Nations
Global	China Takes Advantage of New Desalinization and Water Purification Technologies	China becomes part of a Future Global System Trading Fresh Water

Source: Created by author.

China Exploits its Position as Upper Riparian State of Freshwater Flows Emanating from the Tibetan Plateau—Regional Realism

Table 2. China Adopts a Regional Realism Policy

	Realism	Liberal Institutionalism
Regional	China Exploits its Position as Upper Riparian of Fresh Water Flows Emanating From the Tibetan Plateau	China Agrees to Negotiations and Formal Treaties with other Riparian Nations
Global	China Takes Advantage of New Desalinization and Water Purification Technologies	China becomes part of a Future Global System Trading Fresh Water

Source: Created by author.

Realism is based on the foundation that the primary goal of every nation-state is survival in an international system defined by anarchy, in which there is no central authority or inherent structure that can effectively monitor and enforce order between sovereign countries.[32] The

[32] Anne-Marie Slaughter, "International Relations - Principal Theories," in *Max Planck Encyclopedia of Public International Law*, edited by R. Wolfrum (Oxford, UK: Oxford University Press, 2011), accessed August 13, 2014, https://www.princeton.edu/~slaughtr/Articles/722_IntlRelPrincipalTheories_Slaughter_20110509zG.pdf, 1.

behavior of nation-states can only be influenced by persuasion, rewards, punishment, or force. In an anarchic system, the key to survival is state power. Only through power, primarily coercive military and economic power derived through material capacity, can a nation-state ensure its survival.[33] Therefore, nation-states will continue to ensure they have sufficient power to not only defend themselves and their current national interests, but also to advance their material capacity necessary to ensure their future survival.[34] China's rise as a world power has been primarily focused on: (1) growing economic and trade muscle catapulting it to the second largest economy in the world just behind the United States; (2) expanding military capabilities including development of its strategic missile force, army, air force, and navy as exemplified by the production of its first indigenous aircraft carrier; (3) rising maritime ambitions resulting in territorial disputes with Vietnam, Japan, and the Philippines, as well as India; and (4) insatiable demand for acquiring strategic resources (iron ore, oil, copper, coal, etcetera) throughout the Middle East and Africa.[35]

One serious area that continuously escapes attention is China's dramatic rise as a supreme hydro-hegemon.[36] With the world's most resource-hungry economy, China is pursuing an aggressive strategy to secure access to critical resources, such as freshwater, minerals, and energy in an attempt to gain an unprecedented advantage over its nation-state rivals.[37] China realizes that its vast conventional and nuclear military power can be mitigated by neighboring

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[33] Ibid.

[34] Ibid.

[35] Seth Cropsey, "China's Growing Challenge to U.S. Naval Power," *Wall Street Journal*, June 20, 2013, accessed June 7, 2014, http://online.wsj.com/news/articles/SB10001424127887324798904578531781367548350#.

[36] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 229.

[37] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 229.

states unilaterally or through a combination of alliances, such as the Association of Southeastern Nations (ASEAN), the US-Japan Mutual Security Treaty, as well as numerous bilateral military agreements including the one just signed between India and Vietnam.[38] Although China's vast nuclear arsenal may be neutralized by Russia, India, and the United States, one area that cannot be alleviated is China's control over freshwater flows emanating from Asia, specifically from the Tibetan Plateau.[39] Just as Saudi Arabia controls vast reserves of oil within its borders, China controls the vast majority of freshwater sources within its borders and throughout much of Asia. China's annexation of the Tibetan Plateau in 1959, effectively gave it control over the world's largest and most accessible source of freshwater in all of Asia, making it the upper riparian of the major transboundary river systems to the greatest number of countries in the world, extending from the Indochina Peninsula and South Asia to Kazakhstan and Russia.[40]

One contributor to the 2010 NIC Conference Report correctly stated, "Whoever controls the Tibetan Plateau has the leverage."[41] This is not only due to the fact that the Tibetan Plateau serves as the source of freshwater for rivers that sustain approximately half the world's population, but Asia also has less freshwater than any other continent on Earth except Antarctica—3,920 cubic meters per person.[42] In addition, China's rivers flow outward making it only one percent dependent upon foreign sources for its freshwater needs, while many of its neighboring countries including Cambodia, India, Myanmar (Burma), Pakistan, Thailand, and

[38] Beina. Xu, "South China Sea Tensions," Council on Foreign Relations, May 14, 2014, accessed June 14, 2014, http://www.cfr.org/china/south-china-sea-tensions/p29790.

[39] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 230.

[40] Ibid.

[41] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 4.

[42] Ibid., 25.

Vietnam are heavily dependent upon freshwater sources originating from China.[43] This in effect means that China can eventually control the freshwater flows to nearly half of the world's populations and use this material capacity to increase its regional power and influence over other nation states throughout South and Southeast Asia to achieve international outcomes in its favor.[44] Lower riparian countries that will be most affected by China's deliberate restriction of freshwater flows through large hydro-engineering projects, are nations that are the furthest downstream on rivers like the Mekong and Brahmaputra. This includes Vietnam, which depends upon the Mekong for rice crop irrigation and local fisheries, as well as Bangladesh, whose very future is threatened by loss of freshwater for human consumption.[45]

China has also had freshwater disputes with many other nations throughout South Asia regarding the damming of large rivers originating from the Tibetan Plateau. For example, the Mekong River is one of the largest rivers in the world and flows south from Tibet through China into Burma, Cambodia, Laos, Thailand, and Vietnam, and provides irrigation, fishing, and trade routes to these countries.[46] By 2010, China had completed four large dams along the Mekong and four additional dams were under construction. These dams are jeopardizing the freshwater supply of these lower riparian nations and the livelihoods of their citizens who rely on the Mekong

[43] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 25.

[44] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 231.

[45] Ibid., 239.

[46] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 6.

river.[47] The Mekong's low water levels resulted in depleted irrigation systems and fisheries, and also halted boat traffic in many sections of the river.[48]

The leaders of these nations are now expressing alarm over China's actions after it commissioned the Nuozhadu Dam, the largest on the Mekong River in 2012. During a recent Asia-Pacific Economic Cooperation Conference in Vladivostok, Russia, Vietnamese President Truong Tan Sang warned that "tensions over water resources are threatening economic growth in many countries and representing a source of conflict."[49] Without naming China, President Troung Tan Sang also stated "dam construction and stream adjustments by some countries in upstream rivers constitute a growing concern for too many countries and implicitly impinge on relations between relevant countries."[50]

Officials attending the Mekong River Commission Summit, in particular Thailand's representatives, faulted Beijing for basically ignoring them. Pang Zhongying, of Renmin University in Beijing stated, "it's unfair to say this is China's responsibility."[51] Nevertheless, China's unwillingness to release water resource data combined with its secrecy in planning water diversion projects aggravate regional suspicions making it easier for the lower riparian countries

[47] Joshua Eisenman, Briefing Memorandum and Powerpoint Presentation, "China's Water Related Crises: Problems, Policies and Consequences," American Foreign Policy Council, Washington, DC, July 2010, 6.

[48] Ibid.

[49] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 239.

[50] Parameswaran Ponnudurai, "Water Wars Feared Over Mekong," *Radio Free Asia*, September 30, 2012, accessed June 1, 2014, http://www.rfa.org/english/commentaries/east-asia-beat/mekong-09302012160353.html.

[51] China Daily, "Climate change to blame for Mekong drought," *China-Wire*, April 3, 2010, accessed June 1, 2014, http://china-wire.org/?p=4981.

to blame China for their water crises.[52] In response to complaints from lower riparian countries, China finally agreed to release data regarding flow rates and other water management information, which was slow in coming and often incomplete.[53] Advances in remote sensing data and greater access to commercial imagery may enable other nations to monitor China's water management activities.[54] However, sovereignty concerns, prohibitive costs, competing priorities, and shutter controls may enable China to conceal its water management activities until construction of dams and other infrastructure start making it nearly impossible to mitigate transboundary freshwater disputes through treaties or international arbitration.

As a result, lower riparian nations believe China is deliberately manipulating upstream freshwater resources, which directly threatens their food, water, environmental, and economic security. As freshwater scarcity becomes more rampant throughout Asia and territorial disputes with Japan and ASEAN involving marine resources and energy exploration throughout the South China and East China Seas, China will be increasingly viewed as an aggressive hegemon impeding progress toward achieving comprehensive planning, management, and treaties governing transboundary freshwater resources.[55]

To date, China has shown little concern regarding potential conflicts involving transboundary water resource issues, indicating that it is pursuing a Regional Realist approach with its neighbors regarding water management issues. It also views international pressure for greater transparency regarding water management matters as blatant interference in its sovereign

[52] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 4.

[53] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 25.

[54] Ibid., 26.

[55] Ibid., 4.

internal affairs.[56] As China's diplomatic, economic, and military power continues to grow, it probably will not agree to participate in international environmental regulatory regimes or water dispute mechanisms.[57]

Even though negotiations between India and China to achieve bilateral cooperation on water sharing agreements over the Brahmaputra River are often contentious, India recognizes that it is in no position to wage war with China despite continued disagreements over freshwater flows.[58] During the past decade, China resurrected a long-dormant claim to India's northeastern state of Arunachal Pradesh (bordering both Burma and Tibet), by unveiling plans to build a large series of dams on the Brahmaputra River before it actually enters Arunachal Pradesh.[59] China's claim to the Indian controlled Arunachal Pradesh region parallels the way it sought to seek control of the Japanese controlled Senkaku Islands, which it calls the Diaoya Islands, only after the issue of developing the vast oil and natural gas reserves throughout the East China Sea arose.[60] In 2009, China attempted to block a 2.9 billion dollar loan to India from the Asian Development Bank on the grounds that part of the loan was destined for water projects in Arunachal Pradesh, the state that includes Tawang, a city controlled by India that lies at the center of a delicate land-border dispute between China and India.[61] This was the first time that China

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[56] Ibid., 30.

[57] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 30.

[58] Roomana Hulki, "India-China: A Water War over the Brahmaputra?" Institute for Peace and Conflict Studies, April 30, 2014, accessed July 31, 2014, http://www.ipcs.org/article/south-asia/india-china-a-water-war-over-the-brahmaputra-4415.html.

[59] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 177.

[60] Ibid.

[61] Edward Wong, "China and India Dispute Enclave on Edge of Tibet," *The New York Times*, September 3, 2009, accessed July 30, 2014, http://www.nytimes.com/2009/09/04/world/asia/04chinaindia.html?ref=global-home&_r=0.

sought to influence a territorial dispute through a multilateral institution, in this case the Asian Development Bank. Adding to tensions, both India and China have been building up their military forces throughout the disputed region prompting one Indian military official to declare, "that China has replaced Pakistan as India's biggest threat."[62]

Brahma Chellaney, an Indian geopolitical analyst summed it up this way, "China is engaged in the greatest water grab in history. Not only is it damming the rivers on the plateau, it is financing and building mega-dams in Pakistan, Laos, Burma, and elsewhere, and making agreements to take the power. China-India disputes have shifted from land to water. Water is the new divide and is going to be center stage in politics. Only China has the capacity to build these mega-dams and the power to crush resistance. This is effectively war without a shot being fired."[63] With China's continued emphasis on massive water diversion projects to satisfy its growing domestic demand for freshwater and electric power, as well as its lack of transparency and refusal to enter into meaningful water sharing agreements, China and its lower riparian neighbors will continue to interpret its dam construction prowess as an extension of its economic and military power.[64]

Therefore, China's adoption of a Regional Realist approach by exploiting its upper riparian position regarding freshwater disputes with its lower riparian neighbors, will lead to freshwater stress or scarcity, possibly resulting in interstate conflicts or political instability throughout Asia. Many analysts argue that disputes involving freshwater flows between China and its neighbors in South and Southeast Asia could be eased through new desalination and water

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[62] Wong.

[63] John Vidal, "China and India 'water grab' dams put ecology of Himalayas in danger," *The Guardian*, August 10, 2013, accessed July 31, 2014, http://www.theguardian.com/global-development/2013/aug/10/china-india-water-grab-dams-himalayas-danger.

[64] Chellaney, *Water - Asia's New Battleground*, 255.

purification technologies, as well as through negations and formal treaties that are examined next in this monograph.

China Takes Advantage of New Desalinization and Water Purification Technologies—Global Realism

Table 3. China Adopts a Global Realism Policy

	Realism	Liberal Institutionalism
Regional	China Exploits its Position as Upper Riparian State of Fresh Water Flows Emanating From the Tibetan Plateau	China Agrees to Negotiations and Formal Treaties with other Riparian Nations
Global	China Takes Advantage of New Desalinization and Water Purification Technologies	China becomes part of a Future Global System Trading Fresh Water

Source: Created by author.

President John F. Kennedy famously remarked that the nation, which developed a good saltwater desalinization process, would derive longer lasting benefits from it than being the number one nation in space.[65] Desalinization is the process of purifying water for both consumptive uses including human and industrial uses, as well as non-consumptive agricultural use. It separates saline water into a freshwater stream using a low concentration of dissolved solids and a concentrated brine stream, which remove contaminants including suspended solids, pathogenic organisms, and toxic chemicals from the contaminated waters.[66] According to *The United Nations (UN) World Development Report 2014*, there are more than 17,000 desalinization plants operating in approximately 150 countries.[67] These desalinization plants produce

[65] Larbi Bouguerra, *Water Under Threat* (New York: Zed Books, Ltd., 2006), 52.

[66] NIC, *Impacts of Technology on Freshwater Availability to 2040* (Washington, DC: Strategic Business Insights, January 2011), ii.

[67] United Nations World Water Assessment Program, *The United Nations Water Development Report 2014, Water and Energy. Volume 1* (Paris, France: United Nations Educational, Scientific and Cultural Organization, 2014), accessed August 4, 2014, http://unesdoc.unesco.org/images/0022/002257/225741E.pdf.

approximately twenty-one billion gallons of potable water a day for nearly 300 million people, in arid places, such as Australia and the Middle East.[68]

However, water desalinization plants that convert salt water to freshwater are large, need to be built along coastlines, require large amounts of electric power to operate, and produce large amounts of discarded brine that are environmentally hazardous to dispose of in the marine ecosystem.[69] Although costs vary, the lowest price for desalinated seawater from a reverse osmosis plant is around 750 billion dollars an acre-foot (325,851 gallons)—more than double the average cost of groundwater, which is a another impediment to constructing desalinization plants using existing technology.[70]

New technologies are currently being developed that could make the desalinization process more efficient, less energy intensive, and reduce the hazardous amounts of brine that cause great damage to our ecosystem. China could employ a Global Realist approach, or more specifically self-help, to take advantage of new desalinization and water purification technologies to ease its freshwater shortages. These new desalinization and water purification technologies could also reduce the dependence of other nations on freshwater sources originating from the Tibetan Plateau thereby, lowering political tensions throughout the region. A new process using forward osmosis developed by Trevi Systems, pulls water molecules across a membrane, leaving the salt and other impurities behind, and when low heat is applied, the bioengineered solution

[68] International Desalination Association, "Desalination by the Numbers," 2014, accessed August 14, 2014, http://idadesal.org/desalination-101/desalination-by-the-numbers/.

[69] Bouguerra, 52.

[70] Cheryl Katz, "New Desalination Technologies Spur Growth in Recyling Water," Yale: Environment 360, June 3, 2014, accessed August 3, 2014, http://www.thestar.com/news/world/2014/05/12/china_wakes_up_to_its_water_crisis.html.

separates out like oil from water, enabling the clean water to by siphoned off.[71] This is important because Dr. David Sedlak and other experts believe that although desalinization of seawater is an important contributor to alleviating freshwater scarcity, it is much more practical and sustainable to desalinate less-salty brackish water and use technology to recycle wastewater.[72] Technologies being developed by Trevi Systems can also economically purify brackish groundwater, industrial effluents, and other forms of liquid contaminates.[73] In addition, entrepreneurs and engineers across the globe are now trying to devise greener desalination techniques that include alternatives to traditional reverse osmosis. For example, Israel, whose own reliance on desalinated water has made it a world leader in the process, has come out with several state-of-the-art technologies, including a novel semi-batch reverse osmosis process developed by Desalitech that reduces energy requirements and brine deposits, and a chemical-free plant in a box, produced by Integrated Design Engineering Technologies.[74]

China is currently making plans to build enough seawater desalinization plants by 2019 to supply over thirty percent of Beijing's residents with domestic tap water according to Wang Xiaoshui, Director of the Desalinization Department at Beijing Enterprises Water Group.[75] In March 2012, Beijing Enterprises Water Group started desalinating seawater, transporting 50,000 tons of freshwater from the Caofeidian coastal land reclamation project about 200 kilometers

[71] Ibid.

[72] Katz.

[73] Ibid.

[74] Ibid.

[75] Wang Yiqiong, "Seawater to supply Beijing in 2019," *Global Times,* April 14, 2014, accessed August 4, 2014, http://www.globaltimes.cn/content/854547.shtml.

from Beijing near Tianjin.[76] The eventual goal is to be able to process approximately one million tons of desalinized water per day by 2019 to meet the freshwater demands of Beijing's citizens.[77]

Another area that China must improve on is wastewater treatment and recovery. According to a report compiled by the 2030 Water Resources Group, China's demand for freshwater is expected to reach 818 billion cubic meters, against a current supply which is only 618 billion cubic meters. However, substantial industrial and domestic wastewater contamination makes the quality-adjusted supply-demand gap even larger than the quantity only gap; due to the fact that twenty-one percent of China's available surface water resources are unfit for even agricultural uses.[78] A NIC Conference Report added that water pollution was becoming China's most important water challenge with seventy-four percent of the groundwater found in industrialized and urban areas deemed unfit for human contact.[79] Ma Jun, Director of the Institute of Public and International Affairs in Beijing, is now having to deal with a serie of approximately 450 so-called cancer villages across China.[80] According to recent Chinese government reports, more than seventy percent of China's lakes and rivers are polluted, with almost half containing water that is unfit for human consumption or contact. This was recently confirmed by 4,700

[76] Ibid.

[77] Ibid.

[78] 2030 Water Resources Group, "Charting our Water Future," McKinsey & Company, 2009, accessed February 14, 2014, http://www.2030wrg.org/wpcontent/uploads/2012/06/Charting_Our_Water_Future_Final.pdf.

[79] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 3.

[80] Raveena Aulakh, "China wakes up to its water crisis," *The Toronto Star*, May 12, 2014, accessed August 5, 2014, http://www.thestar.com/news/world/2014/05/12/china_wakes_up_to_its_water_crisis.html.

underground water-quality testing stations that showed nearly sixty percent of all water supplies to be relatively bad or worse.[81]

The majority of China's point-source pollution comes from unregulated or loosely regulated industries including paper, textile, and high-tech businesses that have dumped toxic chemicals or untreated wastewater into rivers, lakes, and reservoirs.[82] Most of the non-point source pollutants result from pesticides and fertilizer-laden runoffs that occur from agricultural areas, as well as runoff from landfills and urban areas.[83] Although desalinization and wastewater reclamation programs could become long-term contributors to meeting China's freshwater needs, they are expensive requiring large monetary investments upfront, take time to integrate into existing water distribution systems, and are susceptible to bureaucratic corruption at the local levels.

Increased use of new desalination and water purification technologies will only reduce political tensions between China and its riparian neighbors if it stops the water diversion projects in its territory on each of the major international river systems it controls that originate from the Tibetan Plateau. In addition, the success of this option could also depend upon the political and economic capabilities of China's lower riparian neighbors to utilize these new desalinization and water purification technologies. Finally, regardless of new water desalinization and purification techniques, for the foreseeable future, China will be able to threaten or actually reduce freshwater flows from the Tibetan Plateau as material power to influence the behavior of the lower riparian nations throughout South and Southeast Asia.

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[81] Ibid.

[82] Aulakh.

[83] NIC, *Water Choices in China: Challenges and Opportunities Through 2040*, 14.

China Agrees to Negotiations and Formal Treaties with Other Riparian Nations—Regional Liberal Institutionalism

Table 4. China Adopts a Regional Liberal Institutionalist Policy

	Realism	Liberal Institutionalism
Regional	China Exploits its Position as Upper Riparian State of Fresh Water Flows Emanating From the Tibetan Plateau	China Agrees to Negotiations and Formal Treaties with other Riparian Nations
Global	China Takes Advantage of New Desalinization and Water Purification Technologies	China becomes part of a Future Global System Trading Fresh Water

Source: Created by author.

Liberal institutionalism, as advocated by Joseph Nye and Robert Keohane during the 1970s, is an alternative to realism regarding international theory.[84] Liberal institutionalism stresses the roles that common goals occupy in the international system and the ability of international organizations, such as the UN and World Bank to get nation-states and organizations to cooperate to achieve important objectives including stopping nuclear proliferation, preventing international terrorism, and alleviating world hunger.[85] In order for international institutionalism to work, nation-states must cooperate, and in effect, yield some of their sovereignty to construct integrated communities that promote economic growth and respond to regional and international security issues, without relying on military force.

[84] Rebecca Devitt, "Liberal Institutionalism: An Alternative IR Theory or Just Maintaining the Status Quo?" E-International Relations, September 1, 2011, accessed August 13, 2014, http://www.e-ir.info/2011/09/01/liberal-institutionalism-an-alternative-ir-theory-or-just-maintaining-the-status-quo/.

[85] Ibid.

In the case of freshwater sources originating from the Tibetan Plateau, liberal institutionalists argue that adequate freshwater flows could be available to China and to each of its riparian neighbors as well, through increased diplomacy (soft power) which would enhance cooperation in the form of international law through treaties arranged by the UN or World Bank, for example.[86] Settling regional freshwater disputes through international institutions offers several advantages to the Chinese. As the foremost upper riparian state on freshwater flows emanating from the Tibetan Plateau, China would be in a position to develop guiding principles and norms regarding shared waterways for all of Asia.[87] One possible organization that China and its riparian neighbors could use to peacefully resolve regional freshwater issues is the Asia-Pacific Water Forum (APWF) that was established in September 2006.[88] The APWF was launched and supported by the Asian Development Bank, and offers a forum in which senior leaders from China and other nations of South and Southeast Asia could meet to discuss and articulate joint strategies and learn about new technologies and practices regarding freshwater conservation, efficiency, and management.[89] This is critical because nearly all countries throughout Asia are now confronting similar challenges regarding freshwater for consumptive and non-consumptive uses.

Another advantage of adopting a Regional Liberal Institutionalist approach by China is that it could reduce the influence of the United States with its riparian neighbors throughout South and Southeast Asia. Brahma Chellaney points out many Asian nations and the United States have different blueprints on how the world will look in the future. Important Asian

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[86] Devitt.

[87] Chellaney, *Water - Asia's New Battleground*, 302.

[88] Asia-Pacific Water Forum, "Why an Asia-Pacific Water Forum?" September 27, 2006, accessed August 14, 2014, http://www.apwf.org/about/index.html.

[89] Ibid.

countries, such as India, Indonesia, Japan, South Korea, and Vietnam desire a multipolar Asia and a multipolar world, whereas the United States seeks a multipolar Asia while it aims to continue being the world's only superpower despite its economic decline. By contrast, China desires a multipolar world and a unipolar Asia with it emerging as the sole regional superpower.

To date, China has not cloaked its ambitions to be the dominant power in Asia, and has become more assertive in territorial disputes with Japan and ASEAN involving marine resources and energy exploration throughout both the East China and South China Seas. Also, as previously mentioned, China has resurrected a long-dormant claim to India's northeastern state of Arunachal Pradesh (bordering both Burma and Tibet), by unveiling plans to build a large series of dams on the Brahmaputra River before it actually enters Arunachal Pradesh.[90] By employing these aggressive actions against neighboring countries throughout South and Southeast Asia, China is inadvertently forcing these nations to rely increasingly on the United States to guarantee their security and protection through treaties, weapons sales, joint military exercises, and basing agreements.[91]

Even if the APWF or other organizations are successful in getting China to actively participate in regional agreements regulating water flows across international boundaries, the UN 1997 Convention on the Non-Navigational Uses of International Watercourses Commission fails to address the key issue regarding interstate water disputes—allocation guidelines. [92] Furthermore, cases by the International Court of Justice (ICJ) are heard and decided upon only by the consent of the parties involved, and most significantly, there are no practical enforcement

[90] Wong.

[91] Beina Xu, "The U.S.-Japan Security Alliance," Council on Foreign Relations, July 1, 2014, accessed August 14, 2014, http://www.cfr.org/japan/us-japan-security-alliance/p31437.

[92] Jerome Delli Priscoli and Aaron T. Wolf, *Managing and Transforming Water Conflicts* (New York: Cambridge University Press, 2009), 11.

mechanisms to back up the International Court of Justice's rulings.[93] The outcome of international water disputes will often be decided on the relative power—diplomatic, information, military, and economic—of the nation-states involved in the disagreement. This is especially true if one of the states involved in the international water dispute is a global or regional hegemon.[94] If the upper riparian nation is economically and militarily stronger than the lower riparian nation, absent any formal treaty or international arbitration, the only thing that the lower riparian nation may be able to do is protest the actions of the upper riparian nation.[95] If the lower riparian state is highly dependent upon the freshwater flows of the international river and is militarily stronger than the upper riparian, then armed conflict by the lower riparian is more likely to ensure access to freshwater sources for continued prosperity and survival.[96] Therefore, if water stress or water scarcity becomes a reality in many regions of the world and more riparian nations believe their access to usable freshwater is threatened, there could be more threats of force or nations undertaking military action to ensure access to freshwater sources.

There are indications that China may be examining a Regional Liberal Institutionalist model regarding freshwater flows emanating from the Tibetan Plateau. Chinese President Xi Jinping and Premier Li Keqiang now realize that China's water policies need to address the fading quantity and quality of available freshwater resources, both within China and flowing across its international borders to lower riparian nations.[97] During the 18th Communist Party of

[93] Priscoli and Wolf, 11.

[94] Ibid.

[95] Ibid., 180.

[96] Ibid.

[97] Dr. Patricia Wouters and Professer Huiping Chen, "China's 'Soft-Path' To Transboundary Water Cooperation Examined In The Light of Two UN Global Water

the Chinese National Congress, President Xi stated, "We should boost cooperation as an effective way for enhancing common development . . . While pursuing its own, a country should accommodate the legitimate concerns of others . . . We need to work vigorously to create more cooperation opportunities, upgrade cooperation, and deliver more development dividends to our people and contribute more to global growth."[98] Although President Xi's statements may indicate a shift in Chinese policy regarding increased regional cooperation regarding freshwater flows emanating from the Tibetan Plateau, China still has concerns about sovereignty over its own territory. What the Chinese have yet to come to grips with is the balancing of the rights of riparian nations to use the freshwater resources within their territory, and the duty not to interfere with or negatively impact the rights of other riparian nations regarding their access to freshwater resources.[99] The critical question for the Chinese is to what extent international law should come into play regarding the basic principle of watercourses flowing through a nation's sovereign territory. This was one of the key reasons that China voted against the adoption of the UN Convention on the Non-Navigational Uses of International Watercourses Commission, while reserving the right to discuss the uses of international watercourses with its riparian neighbors.[100]

Liberal institutionalists argue there is currently a lack of meaningful institutional and normative frameworks capable of reconciling conflicting demands of shared water resources that transcend international boundaries. Although it may be too optimistic to think that China and its riparian neighbors will be able to develop and successfully utilize new cooperative frameworks

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Conventions – Exploring the Chinese Way," Social Science Research Network, May 25, 2014, accessed August 14, 2014, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2359819,

[98] Wouters and Chen.

[99] Ibid.

[100] Ibid.

that liberal institutionalists would argue are needed to solve international disputes over shared freshwater resources, there are indications that Chinese attitudes are shifting. Chinese Premier Li asserted that, "The peace of the world and the stability of the region cannot be guaranteed without strategic mutual trust between China and India."[101] Statements like Premier Li's infer that China may be examining a Regional Liberal Institutionalist approach regarding their shared transboundary water resources with its riparian neighbors using the Sino-Kazakh legal regime as model or could be simply buying time, while it continues with water diversion projects on the transboundary rivers to satisfy its domestic freshwater needs.[102]

China Becomes Part of a Future Global System Trading Freshwater—Global Liberal Institutionalism

Table 5. Chiina Adopts a Global Liberal Institutionalist Policy

	Realism	Liberal Institutionalism
Regional	China Exploits its Position as Upper Riparian State of Fresh Water Flows Emanating From the Tibetan Plateau	China Agrees to Negotiations and Formal Treaties with other Riparian Nations
Global	China Takes Advantage of New Desalinization and Water Purification Technologies	China becomes part of a Future Global System Trading Fresh Water

Source: Created by author.

Unlike other natural resources, such as iron ore, oil, copper, and natural gas that are subject to the forces of global supply and demand, water is not something that can be easy purchased or traded on global markets. Because bulk water trading on international markets is not

[101] Wouters and Chen.

[102] Ibid.

economically or logistically feasible, attention has recently been focused on the role of virtual water trade.[103] The concept of virtual water or freshwater trading involves the indirect role of water used in the manufacture of goods and services. Experts argue that food imports are nothing more than water imports in disguise and those countries with water issues should leave the production of food to others. The countries that have to import food to conserve water could rely on free trade to export natural resources (oil, iron ore, natural gas, copper, etcetera) or finished products that incorporate high technology (computers, cell phones, weapons, medical supplies, etcetera) in order to generate the hard currency needed to pay for food imports.[104] To reduce the amount of water required and alleviate the amount of harmful fertilizers and pesticides needed for worldwide agriculture production, some experts have proposed the idea of virtual water for countries facing water shortages or water scarcity.[105]

China could adopt a Global Liberal Institutionalist approach by becoming part of a future Global System Trading Freshwater to become less reliant on water sources emanating from the Tibetan Plateau. To understand the benefits and opportunity costs to China and other nations involving virtual water trading, it is useful to understand the sources of freshwater used to irrigate crops that make virtual water trading possible. Precipitation or green water (including nonrenewable fossil water) dominates virtual water crop exports from the leading wheat and corn exporters including Argentina, Australia, the European Union, Ukraine, and the United States.[106] Irrigation or blue water dominates virtual water crop exports from the leading rice exporters

[103] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 104.

[104] Bouguerra, 53.

[105] Ibid., 52.

[106] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 104.

including China, India, Pakistan, Thailand, and Vietnam.[107] Nations that are primary exporters of green virtual water dominate the global food trade, and have much higher water productivity levels pertaining to agricultural production using pesticides and fertilizers, soil and climate conditions, and various farming technologies. Therefore, countries that export goods, especially agricultural products, achieve net water savings because these same goods would take more water to produce in low water productivity countries vice importing them. This is due to the fact that higher water productivity countries use less water for both agriculture and manufacturing, which lowers the virtual water content in virtual water exports.

In theory, water stressed or water scarce countries should find it more economical to import water intensive products rather than producing them domestically. Nonetheless, few if any governments actually consider water productivity and water efficiency in economic decisions involving agricultural and industrial production. After all, it is not easy to determine water content used in many durable goods including automobiles, textiles, and machine tools. For example, it is estimated that it takes approximately 39,090 gallons of water to make a single car, 400 gallons of water to grow the cotton required for an ordinary cotton shirt, and 1,500 gallons of water to produce a single barrel of beer.[108] How many water rich and water scarce nations take these facts under consideration when making economic decisions?

Another important issue is to what extent such trade will help to alleviate water stressed conditions throughout the world. Water scarce nations can slash domestic agricultural production and rely on imports of water intensive crops and meat products to mitigate freshwater shortages at

[107] Ibid.

[108] Brian Merchant, "How Many Gallons of Water Does it Take to Make . . ." Treehugger, June 24, 2009, accessed August 6, 2014, http://www.treehugger.com/clean-technology/how-many-gallons-of-water-does-it-take-to-make.html.

home, but the allure of virtual water trade can be diminished by political and security concerns.[109] A system of importing food to alleviate water shortages may result in countries facing food shortages or food insecurity that could result from political disputes, economic sanctions, trade wars, financial pressures, or armed conflicts between nations.[110] Hence, a virtual-water crop trade would be influenced by interstate political relationships in which nations may not be willing to make virtual water trade deals with countries they do not trust politically, militarily, or economically. Nations may view food as a weapon that can be as compelling as bombs or guns, and attach strategic importance to food security as a means of national sovereignty. Even today, the Western nations use food aid as leverage to reign in North Korea.[111]

Domestic economic and social conditions are also very important when it comes to determining whether a water scarce nation should engage in virtual water trade by importing food. Although virtual water importation could ease immediate water problems in many nations, shifting food production to other countries could directly lead to social unrest among the large rural populations in many countries.[112] Discouraging agriculture production in many developing nations could undercut the very thing that the UN cites as critical to reducing rural poverty.[113] It could also result in mass migrations to urban areas that would cause further water stress due to insufficient infrastructure, as well as social problems and economic hardships that would further delegitimize or possibly destabilize a national government.

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[109] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 111.

[110] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 109.

[111] Ibid., 112.

[112] Ibid., 113.

[113] Ibid.

Finally, do water rich nations have enough renewable water resources to employ virtual water trade with water stressed nations? The world's leading virtual water exporters including the United States, China, India, Pakistan, Australia, Uzbekistan, and Turkey are experiencing various degrees of water stress within their borders.[114] Each of these countries is suffering water stress from a combination of agricultural irrigation, economic growth and industrialization, urbanization, pollution, population growth, and inefficient water distribution and reclamation systems.[115] Hence, even in countries that are water endowed, the true costs of virtual water exports do not accurately reflect water resource depletion and environmental damage, as well as the looming crisis that could occur if a nation enters a prolonged period of water scarcity.[116]

China faces many of these problems relating to virtual water export and import issues. The stark reality is that world food markets presently are not great enough to allow water stressed countries to markedly shift to virtual water imports.[117] If China were to suddenly become a major importer of agricultural products, meat, poultry, and eggs for example, it would seriously destabilize global food markets by drastically reducing available food supplies and raising prices for nations throughout Africa, as well as other Asian nations including the Maldives and Bangladesh.[118]

In addition to food insecurity, China would also face other social and economic problems. Economic dislocation of millions of Chinese citizens from rural farming areas to large

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[114] Arjen Y. Hoekstra and Mesfin M. Mekonnen, "The water footprint of humanity," *Proceedings of the National Academy of Sciences* 109, no. 9 (February 28, 2012): 3232-3237, accessed August 11, 2014, http://www.pnas.org/content/109/9/3232.full.

[115] Ibid.

[116] Ibid.,

[117] Ibid.

[118] Ibid.

cities would seriously strain urban infrastructure, place greater demands on local governments for needed services including medical and educational facilities, and result in economic distortions brought about by unemployment and inflation. This already happened when China experienced an economic slowdown during the 2008 recession and during the presently overheated real-estate market. Zhou Yongkang, a member of China's politburo warned provincial officials that they needed to find better methods of social management aimed at mitigating violence and providing a safety net when facing negative effects of a market economy.[119] This is especially important because China's ruling Communist party relies on torrid economic growth to maintain political legitimacy. Virtual water imports could dislocate large swaths of society, including migrant farm laborers and disgruntled civil servants who manage China's farming and water apparatuses at the provincial and local levels. Government control of the economy has been a central pillar of its political authority, and altering China's agricultural and industrial markets will require the party to walk a thin and perilous line.[120] Many Chinese analysts believe that an economic slowdown and double-digit inflation were important contributors in the Tiananmen Square uprising that killed many citizens and nearly brought down the Communist Party.[121]

China could already be on the way to being a major importer of virtual freshwater from the United States because its food imports are rising, while its food exports to the United States

[119] Thom Philpott, "6 Charts That Show How We Became China's Grocery Store and Wine Cellar," *MotherJones,*.May 14, 2014, accessed August 7, 2014, http://www.motherjones.com/tom-philpott/2014/05/china-us-food-pork-wine-export-import.

[120] John Lagervist, "China's Risky Reforms: Why Beijing Has Reasons to Worry," *Foreign Affairs,* February 14, 2014, accessed August 7, 2014, http://www.foreignaffairs.com/articles/140951/johan-lagerkvist/chinas-risky-reforms.

[121] Paul Waldmeir and Jamil Anderlini, "China to prepare for social unrest," *Financial Times,* December 4, 2011, accessed August 7, 2014, http://www.ft.com/cms/s/0/61673902-1e6e-11e1-bae4-00144feabdc0.html#axzz39jDhxRNS.

are leveling out.[122] In 2012, China overtook Mexico as the foremost importer of US food, consuming an estimated twenty-five billion dollars' worth of food annually from the United States.[123] China's surge in demand for meat, nuts, and livestock feed (alfalfa, corn, and soybeans) are all responsible for the surge of US food imports, indicating that China is already relying on virtual water imports from and the United States and other Western nations.

This has many implications for both the United States and China. In the United States, agribusiness will continue to expand putting pressure on two water stressed regions—the Midwest's Corn Belt and California's Central Valley—where alfalfa, vegetables, and nuts are grown.[124] Chaotic weather patterns throughout the Midwest are resulting in losses of nutrient rich topsoil, while severe drought is rapidly drawing down available water resources to irrigate parched farmland.[125] Without precipitation relief, water stress and water scarcity will continue to grow throughout the United States especially in the western regions of the country.[126]

China will have to better manage its freshwater resources or face the possibility of increased virtual water imports from the United States, which it may view and source of food insecurity making it susceptible to US diplomatic and economic pressure. This could determine which approach China chooses regarding freshwater sources emanating from the Tibetan Plateau and possible US policy options examined in the next section.

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[122] Philpott.

[123] Waldmeir and Anderlini.

[124] Ibid.

[125] Ibid.

[126] Jim Carlton, "California Drought Squeezes Wells," *The Wall Street Journal*, August 28, 2014, accessed August 30, 2014, http://online.wsj.com/articles/california-drought-squeezes-wells-1409268495?KEYWORDS=california+deep+water+wells.

Historical US Polciy Options toward China

The important question for the United States is what can it do to ensure that competition for freshwater resources throughout Asia does not result in overt conflicts? To achieve this, the United States will need to successfully engage China as its political influence, economic power, and military capabilities continue to grow worldwide, especially throughout Asia. America's responses regarding China's water policies will largely depend on the overall status of Sino-American relations.[127]

During the past forty years, the United States has consistently used a policy of engagement in dealing with China (see figure 2). US presidents have employed elements of America's diplomatic, information, military and economic power to various degrees using the model below, especially regarding trade and security issues. [128]

[127] Jessica Williams, "The International Implications of China's Water Policies," E-International Relations, February 15, 2013, accessed August 25, 2014, http://www.e-ir.info/2013/02/15/chinas-water-policies-and-their-international-implications/.

[128] Watanabe.

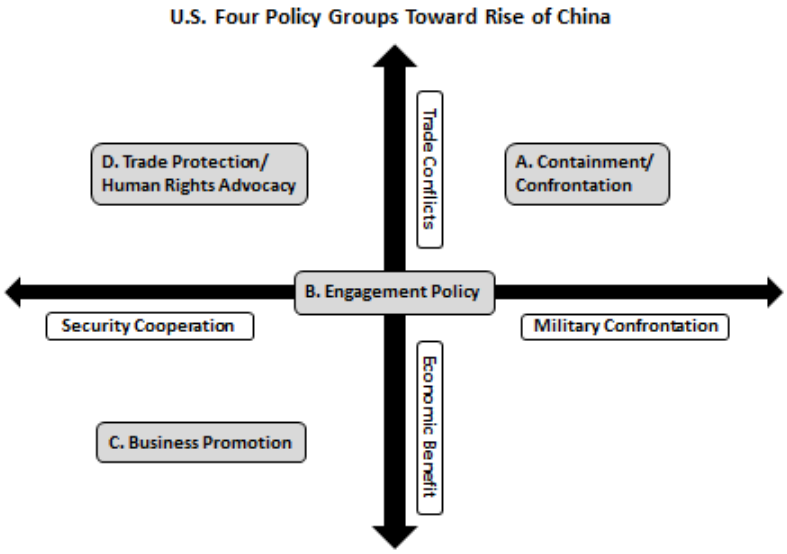

Figure 2. US Directions toward China

Source: Tsuneo Watanabe, "US Engagement Policy toward China," The Tokyo Foundation, January 31, 2014, accessed August 23, 2014, http://www.tokyofoundation.org/en/articles/2014/us-engagement-policy-toward-china.

Each of these four blocks has competing constituencies that US presidents must try to balance, which is why successive administrations will intentionally be vague in describing their policies with China. Group A, Containment and Confrontation (figure 2), represents the hawks, such as former Vice-President Richard Cheney and Princeton University Professor Aaron Frieberg, who served as Cheney's national security advisor.[129] Both view China's increasing military and economic power as a direct challenge to US interests regionally and globally, and do not believe that China will become more democratic, and that economic interdependence will not be a sufficient stabilizing force to prevent Sino-American clashes. Vice-President Cheney and other neoconservatives consider China's authoritarian, one-party rule combined with its rising

[129] Yoichi Kato, "Interview/Aaron Friedberg: More Balancing Needed than Engagement with China," *The Asahi Shimbun*, September 13, 2012, accessed August 26, 2014, http://ajw.asahi.com/article/views/opinion/AJ201209130026.

economic and military power as being an international game changer. Policymakers and military leaders in Group A argue the United States and its allies must consistently scrutinize Chinese investments by state controlled companies in order to prevent flows of military technology, data thefts, and cyber-attacks against the United States government and corporations.[130] Neoconservatives ultimately believe in using a confrontational security policy toward China bordering on containment, as was done against the former Soviet Union until 1992.

Group B, Engagement Policy (figure 2), represents the moderates and pragmatists that believe the United States must continue to engage China to varying degrees using both soft and hard power. Most US policymakers and military leaders fall into this group, which was first championed by former President Richard M. Nixon, during his historic visit to China in 1972. Group B can also be broken down further into two distinct subgroups, each with slightly different policy approaches regarding China. The first group includes Zbigniew Brzezinski, former National Security Advisor to President Carter, who advocates a sunshine policy arguing economic cooperation and mutual economic interdependence will continue to encourage China to be a responsible and nonthreatening partner in regional and global political security issues.[131] With emphasis on mutual economic interests, this subgroup is closer to Group C. The second subgroup includes Andrew Marshall, Director of the Defense Department's Office of Net Assessment, who believes that although engagement with China is critical to Sino-US relations, it is also important to hedge against potential military confrontations with China.[132] He cites Defense Department reports stating the People's Liberation Army continues to pursue "a long-

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[130] Watanabe.

[131] Zbigniew Brzezinski, "The Group of Two that could change the world," *The Financial Times*, January 13, 2008, accessed August 26, 2014, http://www.ft.com/intl/cms/s/0/d99369b8-e178-11dd-afa0-0000779fd2ac.html#axzz3BdBARr18.

[132] Watanabe.

term, comprehensive military modernization program to win 'local wars under conditions of information,' or conditions of high intensity, information centric regional military operations of short duration."[133] This report also mentions China's willingness to maintain peace and stability along the periphery to secure access to resources, capital, and markets, and to avoid direct confrontation with the United States. With emphasis on the hedging against military confrontation, this group is closer to Group A.

Group C, Business Promotion (figure 2), represents an optimistic view that deepening economic ties will hasten China to become a more cooperative participant in regional and global matters.[134] This Group includes Henry Paulson, former Treasury Secretary in George W. Bush's administration, who built a solid network of Chinese business partners during his tenure at Goldman Sachs.[135] As a founding member of the US-China Strategic Economic Dialog, he believes that robust economic growth was and still is the framework in which Chinese leaders view international relations. Mr. Paulson believes engagement of China, especially through economic interests in the most effective way to achieve desired results in both economic and non-economic matters.

Finally, Group D, Trade Protection/Human Rights Advocacy (figure 2), represents primarily liberal Democrats in Congress who believe that protecting American jobs from China's unfair trade and currency practices, as well as its on-going human rights violations, should be the focus of US policy.[136] This Group includes Senator Chuck Schumer (D-NY), who has demanded

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[133] Ibid.

[134] Ibid.

[135] Henry M. Paulson, "A Strategic Economic Engagement," *Foreign Affairs* (September/October 2008), accessed July 21, 2014, http://www.foreignaffairs.com/articles/63567/henry-m-paulson-jr/a-strategic-economic-engagement.

[136] Watanabe.

congressional action using higher import tariffs against countries, namely China, that are deliberately undervaluing their currencies against the US dollar making their products much cheaper than America's domestically manufactured goods, as well as making America's exported products more expensive in their countries.[137] Former House Speaker Nancy Pelosi is also in Group D, citing China's continued human rights violations against individuals in China and Tibet. On her website, she states, "in China and Tibet, people are languishing in prisons for only expressing their ideas and political views."[138] House Minority Leader Pelosi believes that if the United States does not promote human rights in China and self-determination in Tibet, then we lose our moral authority to speak out for human rights in the rest of the world.

US Options to Influence China's Freshwater Policies

China Continues to Employ Regional Realism Involving Freshwater Resources

If China should continue the policy of Regional Realism by exploiting its positon as the upper riparian state of freshwater flows emanating from the Tibetan Plateau, then US policy options could include a mix of A, Containment/Confrontation; D, Trade Protection/Human Rights Advocacy; and a limited form of B, Engagement Policy involving military hedging.

Starting with a Containment/Confrontation policy, the United States should immediately provide remote sensing and commercial geospatial-intelligence data on China's specific water diversion projects; specifically dams to organizations, such as ASEAN, the UN, APWF, and the International Court of Justice. Presentation of direct evidence of water diversion projects along

[137] Charles E. Schumer, "Leading the Fight on China's Mercantilist Exchange Rate Policies," Senator Charles E. Schumer, August 27, 2014, accessed August 27, 2014, http://www.schumer.senate.gov/Issues/trade.htm.

[138] Nancy Pelosi, "Human Rights," Congresswoman Nancy Pelosi, August 27, 2014, accessed August 27, 2014, http://pelosi.house.gov/issues/human-rights.

transnational rivers, would force greater Chinese transparency and force them to consider allowing on-site inspections by representatives from the aforementioned organizations and lower riparian nations, in order to refute incriminating geospatial-intelligence evidence. After all, the United States currently uses geospatial-intelligence and other intelligence data, as well as onsite inspections to monitor arms control agreements with Russia.[139]

The United States could also strengthen or expand existing military alliances between the lower riparian nations throughout South and Southeast Asia, especially India. A military and economically strong India would be a clear counterweight against China's aggressive actions throughout the Asia-Pacific Region.[140] The United States and India are now conducting some joint military exercises together but the United States could make India a more noticeable part of the Asia pivot by including its forces in all the military training and exercises it conducts in the region. India has recently strengthened its political and military ties to ASEAN and Japan, a trend that the United States should continue to encourage.[141] Finally, the United States should consider sharing more intelligence data with India and offer to sell it more advanced weapons, including ships, aircraft, and air defense weapons. India plans to spend as much as 100 billion dollars to upgrade its military capabilities over the next decade, and the United States should ensure interoperability with our forces, as well as those of ASEAN and Japan.[142]

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[139] Spencer Ackerman, "How the U.S. Snoops on Russian Nukes From Space," *Wired*, November 18, 2010, accessed August 30, 2014, http://www.wired.com/2010/11/how-the-u-s-snoops-on-russian-nukes-from-space/.

[140] Nicholas Burns, "Passage to India: What Washington Can Do to Revive Relations With New Delhi," *Foreign Affairs* (September/October 2014), accessed August 30, 2014, http://www.foreignaffairs.com/articles/141851/nicholas-burns/passage-to-india.

[141] Burns.

[142] Andrea Shalal-Esa, "U.S. aims to expand India arms trade by billions of dollars," *Reuters*, April 19, 2014, accessed August 30, 2014, http://in.reuters.com/article/2013/04/18/usa-india-weapons-idINDEE93H0F220130418.

The United States could also impose tariffs and quotas on China's exports of manufactured goods to this country. In July 2013, Senator Sherrod Brown (D-OH) and Senator Jeff Sessions (R-GA), urged President Obama to take definitive action against China's explicit depreciation of its yuan against the dollar, which makes Chinese goods cheaper in the United States. In a joint statement, the two senators wrote, "China's currency manipulation weakens our economic recovery and makes US exports less competitive, which is why we must combat it with every tool in our toolbox."[143] According to an Economic Policy Institute report, ending Chinese currency manipulation would reduce the United States trade deficit by up to 500 billion dollars over three years, increase gross domestic product by up to 720 billion dollars, and create up to 5.8 million American jobs.[144] Another leading critic of China's currency policies is Senator Chuck Schumer (D-NY). He has also sponsored bills to force China to allow the yuan to become a market value currency. Chinese leaders know that a drastic appreciation of the yuan would destabilize China's capital markets and dampen its exports, which could cause rapid economic deterioration leading to social unrest.[145] This of course, could directly threaten the legitimacy of the one-party system currently enjoyed by the Communist Party.

Highlighting human rights abuses and China's unlawful annexation of Tibet after Chinese troops entered into it in 1949 forcing the Dali Lama to flee to India, could also be an effective tactic by calling into question China's control of the Tibetan Plateau. Human Rights Watch recently reported that China "places arbitrary curbs on expression, association, assembly,

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[143] Cameron Saucier, "Senators urge Obama to prohibit Chinese currency manipulation," *USA Today*, June 12, 2014, accessed August 30. 2014, http://americasmarkets.usatoday.com/2014/06/12/senators-urge-obama-to-prohibit-chinese-currency-manipulation/.

[144] Ibid.

[145] Lingling Wei, "China Intervenes to Lower Yuan," *The Wall Street Journal*, February 26, 2014, accessed August 30, 2014, http://online.wsj.com/news/articles/SB10001424052702304071004579406810684766716.

and religion; prohibits independent labor unions and human rights organizations; and maintains Party control over all judicial institutions."[146] Despite this tight control, Chinese officials are seeing 300–500 protests per day indicating citizens are more willing to challenge authorities over volatile issues, such as unpopular land seizures, forced evictions, serious environmental degradation, miscarriages of justice, abuse of power by corrupt government officials, discrimination against minorities, and growing economic inequality.[147] This may provide the United States and other riparian neighbors with the leverage required to encourage China to become to become a responsible party to peacefully settle transboundary water disputes.

Finally, an Engagement Policy should continue to be used in all options employed by the United States regarding China. This is to prevent and ensure that minor incidents involving each country's air and maritime forces operating in the South China and East China Seas do not result in major military clashes. Unlike land wars and even air clashes, naval battles can escalate extremely fast with little or no warning producing unintended consequences for the United States, China, and various other nations that may be directly or indirectly involved throughout the region. This Engagement Policy should continue to include maintaining diplomatic and military contacts at nearly all levels. At the conclusion of a recent ASEAN Conference, all nations emphasized the importance of maintaining peace and stability in accordance with universally recognized principles of international law to mitigate regional tensions.[148]

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[146] Human Rights Watch, "World Report 2014: China," 2014, accessed August 30, 2014, http://www.hrw.org/world-report/2014/country-chapters/china.

[147] Ibid.

[148] Lesley Wroughton, "U.S. to monitor South China Sea for de-escalation after China rebuff," *Reuters,* August 12, 2014, accessed August 30, 2014, http://uk.reuters.com/article/2014/08/12/uk-australia-usa-kerry-idUKKBN0GB0AT20140812.

However, China insists that US actions are encouraging ASEAN and Japan to pursue more aggressive actions and call into question US motives. US State Department Spokeswoman Mary Harf has warned that aggressive Chinese maritime and air interdiction in international territory has been the major drivers of tension and instability.[149] Despite increased tensions, an Engagement Policy involving diplomatic and military exchanges will still be required at all levels by both governments to prevent minor incidents from escalating into major military clashes, such as the Cuban Missile Crisis between the United States and the Soviet Union in 1962.

Each of the three policy options, if employed by the United States in response to Chinese Regional Realism, would provide the greatest risk to overall Sino-US relations. The next section examines US policy options if China should employ Global Realism by taking advantage of new desalinization and water purification technologies.

China Decides to Employ a Global Realism Policy Involving Freshwater Resources

If China decides to pursue a course of Global Realism, or more specifically self-help, by taking advantage of new desalinization and water purification technologies to much greater degrees than it does now, the primary policy option for the United States would be Group C, Business Promotion (see table 7). The United States would be encouraging China to collaborate with both American and foreign corporations, as well as universities to develop and implement new water desalinization and purification technologies that would promote economic cooperation and greater economic interdependence (see figure 1).

China is in the process of spending 3.3 billion dollars over five years on new desalinization plants near Tianjin that it hopes will be a model for others built throughout the country. Built on the water's edge and designed to pull seawater from the Bohai Sea, China hopes

[149] Ibid.

to ease some of its current freshwater stresses using new desalinization plants.[150] However, in addition to being very expensive, each new desalinization plant still requires large amounts of electricity to operate, which will be supplied by coal-fueled power plants that contribute to air pollution, and require large amounts of water for mining and processing coal for fuel.

A new technology developed by a San Francisco start-up called "WaterFX" does not require electricity but instead creates heat used to desalinate water.[151] Instead of using electricity to desalinate the water, a giant 377-foot solar array was installed in a wheat field that slowly rotates to track the sun to capture its energy, turning the water into steam that condenses the water and then separates out the salts and heavy metals, making it useable again. According to WaterFX's founder Aaron Mandell, this new one million dollar thermal desalinization plant is removing impurities from drainage water at half the cost of existing traditional desalinization techniques.[152] Billions of gallons of water lie just below the surface in this region, but are so polluted with toxic levels of heavy metals and salt from water runoff originating from the Panoche foothills, that it must be continuously drained to keep it from poising crops. WaterFX's new technology is allowing this contaminated surface water to be reclaimed, cleansed, and reused for crop irrigation and industrial uses. The pilot project enabled WaterFX to produce 14,000 gallons of purified water a day, while a larger commercial version being constructed should be able to produce approximately 717 million gallons of useable water per day.

New technologies, such as those being developed by WaterFX are going to be critical for the United States, China, India, and other countries confronting water shortages because they

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[150] Celia Hatton, "China banks on desaltionization to help ease water woes," *BBC News*, June 10, 2013, accessed August 31. 2014, http://www.bbc.com/news/world-asia-china-22815145.

[151] Todd Woody, "Water-Cleaning Technology Could Help Farmers," *The New York Times*, February 16, 2014, accessed August 31, 2014, http://www.nytimes.com/2014/02/17/technology/water-cleaning-technology-could-help-farmers.html.

[152] Ibid.

address two critical problems—increased freshwater scarcity and growing contamination from agricultural pollutants that are making more farmland unusable. Although water produced using WaterFX's new technology is still more expensive at 450 dollars per acre-foot of water vice 280 dollars per acre-foot that is supplied by California's Central Valley Project (when it is available), market forces regarding freshwater pricing are now beginning to change drastically making new technologies more competitive. Irrigation costs due to worldwide water shortages are likely to double or triple as more and more growers are expected to purchase water on the spot market as opposed to long-term government contracts. Crop producers will have to pass their increased costs for freshwater onto various consumers, which includes American, Chinese, and Indian consumers. Dennis Falaschi, manager of the Panoche Water District warns that food prices are going to rise considerably over the foreseeable future for all consumers of US farm products.

China could take advantage of new desalinization and water purification technology once it is developed that effectively reduces its dependence and that of other nations on freshwater sources originating from ground aquifers, lakes, rivers, and runoff from locations, such as the Tibetan Plateau for both consumptive and non-consumptive uses, thereby lowering political tensions. If WaterFX's commercial plant proves to be economically viable, it could help address freshwater shortages worldwide and help alleviate freshwater shortages in China, India, and the United States.

If China pursues a Global Realism approach to solving its freshwater problems the United States could leverage multinational corporations that do business with China and its riparian neighbors to ensure they promote freshwater efficiency and sustainability measures into their business models. Large multinational US corporations invest hundreds of millions of dollars in China and Asia, and can adapt policies regarding corporate responsibility faster than governments can promoting water efficiencies to ensure their bottom lines (profits) are

protected.[153] The US government can also use trade and financial incentives to influence the policies of multinational corporations doing business in China and help ensure that it does not steal foreign technology, which may be a major risk with this option.[154]

The US policy option in Group C, Business Promotion encouraging China to collaborate with US and foreign corporations and universities to develop and implement new water desalinization and purification technologies, would result in economic cooperation and economic interdependence that could address freshwater issues throughout Asia. Advocates of Business Promotion believe that economic cooperation and increasing economic interdependence will eventually carry over into other political matters, including the establishment of negotiations and formal treaties regarding freshwater issues between China and its riparian neighbors that will effectively reduce tensions and possibly facilitate a freshwater global trading system that will be examined in the following sections.

China Decides to Employ Regional Liberal Institutionalism Involving Freshwater Issues

If China decides to employ Regional Liberal Institutionalism by agreeing to negotiations and formal treaties with riparian nations other than the primary US policy group would be B, Engagement Policy. The United States would use diplomatic means to encourage China and its riparian neighbors to peacefully resolve freshwater issues through an established venue, such as the APWF in order to develop joint strategies and learn about new technologies, and practices regarding freshwater conservation, efficiency, and management.[155] As cited earlier, this is critical because nearly all countries throughout Asia are now confronting similar challenges regarding

[153] Woody.

[154] Ibid.

[155] Asia-Pacific Water Forum, “Why an Asia-Pacific Water Forum?”

freshwater for consumptive and non-consumptive uses. Lucy Carmody, executive director of Singapore-based investor advisory firm Responsible Research, recently warned that, "Water scarcity is probably one of the biggest risks for investors in China and India."[156] China and India currently have memorandums of understanding that are limited to sharing flood-seasonal hydrological data on the Sutlej/Langquin Zangbu and the Yarlung Tsangpo/Brahmaputra rivers.[157] This may be a basis for cooperation between China and its riparian neighbors that the United States should aggressively promote. Historically, several nations have been able to implement water-sharing agreements offering important opportunities for dialogue even during periods of conflict. According to Aaron Wolf, international water expert at Oregon State University, "Water is a greater pathway to peace than conflict."[158] During the Vietnam War, the United States, North Vietnam, Cambodia and Laos continued the successful negotiations through the Mekong River Commission (MRC) to manage the Mekong River indicating the agreements involving transboundary water issues is still possible during ongoing hostilities.

China is starting to share more hydrological data with the MRC to monitor water levels and improve flood forecasting.[159] Previously, China was sharing hydrological data from June 15th to October 15th every year, but agreed to extend data by thirty days from June 1st to October 31st

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[156] Martin Sieff, "India, China face growing tensions over water," Asia Pacific Defense Forum, December 31, 2012, accessed September 11, 2014, http://apdforum.com/en_GB/article/rmiap/articles/online/features/2012/12/31/india-china-water.

[157] Ibid.

[158] Stephen Leahy, "Water Crisis Hitting Food, Energy – And Everything Else," Global Policy Forum, March 22, 2013, accessed September 11, 2014, https://www.globalpolicy.org/the-dark-side-of-natural-resources-st/water-in-conflict/52367-water-crisis-hitting-food-energy-and-everything-else.html.

[159] Mekong River Commission, "Mekong River Commission and China boost water data exchange," August 30, 2013, accessed September 14, 2014, http://www.mrcmekong.org/news-and-events/news/mekong-river-commission-and-china-boost-water-data-exchange/.

every year, and is now providing data twice per day instead of once.[160] Hans Guttman, the Chief Executive Officer of the MRC Secretariat stated, “"This new agreement is another milestone of the MRC’s cooperation with China. It not only demonstrates the importance of enhanced information-sharing between China and the Mekong Countries, but also their commitment to continue and increase cooperation."[161] Zhang Yue, the Minister-Counsellor and Permanent Representative of China to the Economic and Social Commission for Asia and the Pacific also struck a positive tone regarding China’s data sharing with the MRC noting, “As dialogue partner of MRC, China attaches great importance to the dialogue partnership with MRC and is willing to deepen the substantive cooperation with MRC and its member countries in the areas of hydrological data sharing, hydropower development, flood management and disaster mitigation, environmental protection and personnel exchanges under the principle of friendly consultations and mutual benefit.”[162] The MRC and China are also discussing other areas of cooperation regarding the Mekong River including hydropower development, water resources, navigation and ecosystem preservation.

The United States should continue and Engagement Policy and encourage Chinese participation in organizations, such as the MRC and APWF in order to resolve disputes regarding freshwater resources emanating from the Tibetan Plateau.

China Chooses to be Part of a Future Global System Trading Freshwater

If China decides to become part of a future global system trading freshwater, the primary US policy options would be Engagement Policy and Business Promotion. In fact, China may have

[160] Ibid.

[161] Ibid.

[162] Mekong River Commission, “Mekong River Commission and China boost water data exchange.”

started to participate in a global system trading freshwater in the late 1990s by opening its domestic markets to imported soy and other agricultural products. In addition to importing record amounts of meats, nuts, and livestock feed from the United States, China is importing record amounts of soy from South America, particularly Brazil and Argentina.[163] While China is now starting to rely on imports to reduce the amount of freshwater needed for agricultural production, world food markets may not have additional capacity to allow water stressed countries to markedly shift to virtual water imports.

Increased agricultural imports by China from other countries may encourage more cooperation with its riparian neighbors regarding water flows emanating from the Tibetan Plateau, because it may not face as much pressure to divert freshwater for domestic food production. However, if China does not focus on increased domestic water efficiency, desalinization, and improved reclamation programs, it may not be able to mitigate freshwater shortages no matter how much it participates in a global system for trading freshwater.

Even if the United States adopts Engagement Policies and Business Promotions to encourage China to rely on virtual water trade by importing food and exporting manufactured products to prevent and mitigate freshwater conflicts with its riparian neighbors, it may still face social ramifications from economic dislocation of rural populations forced to relocate from farms to cities.[164] According to a recent NIC report, violent water clashes, such as riots and strikes may not only stem from freshwater shortages or scarcity but from policies implemented to address

[163] John Sullivan, "Virtual water trade has real impacts," Princeton School of Engineering and Applied Science, December 1, 2007, accessed September 2014, http://www.princeton.edu/engineering/water/story-03/.

[164] NIC, *Fresh Water Futures: Imagining Responses to Demand Growth, Climate Change, and the Politics of Water Resource Management by 2040* (Washington, DC: The Stimson Center, May 2010), 5.

them.[165] Therefore, fear of social unrest may limit China's participation in a global system for trading freshwater with other nations by relying on imported agricultural products even if it means alleviating freshwater shortages and reducing tensions with its riparian neighbors.

Finally, the Chinese may be reluctant to rely on increased virtual water imports from the United States and other nations because of increased food insecurity making them susceptible to US diplomatic and economic pressure. The United States and other countries currently use agriculture exports to influence the behavior of other nations—in particular North Korea and the former Soviet Union after it invaded Afghanistan in December 1979. Through both an Engagement Policy and Trade Promotion, the United States may or may not be able to convince the Chinese that a virtual-water crop trade would not be affected by political tensions or territorial disputes between China and its neighbors throughout Asia, as well as issues pertaining to Trade Protection/Human Rights Advocacy.

[165] Ibid.

Conclusion

Freshwater scarcity is quickly emerging as one of the key centers of gravity in world politics and human civilization. Past water abundance is giving way to a new age of freshwater scarcity, and is now overtaking oil as the world's most scarce natural resource. However, unlike oil and other natural resources, freshwater needed to sustain all forms of life is a finite resource of which there is no substitute.[166] An estimated three billion people residing in fifty-two countries will reside in water scarce areas contributing to health issues, economic problems, institutional failures, and civil strife that could expand to the international realm and become major sources of intracountry and intercountry conflicts.[167]

Many important factors contribute to the quantity and quality of a nation's freshwater supply for both consumptive uses and non-consumptive uses. This includes: (1) imbalances between freshwater availability and population density; (2) human activities including water system infrastructure, agriculture, industrial and energy production, mining and urbanization; and (3) climate change.[168]

The Tibetan Plateau contains the world's largest repository of accessible freshwater in the world and is Asia's principle maker of precipitation.[169] In addition to being the water tower of Asia supplying freshwater to some of the most densely populated areas in the world, the Tibetan

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[166] Solomon, 367.

[167] Chou, BeZark, and Wilson.

[168] Peter H. Gleick, *The World's Water Volume 7* (Washington DC: Island Press, 2012), 52.

[169] Chellaney, *Water - Asia's New Battleground*, 52.

Plateau also contains large amounts of rare-earth minerals including lithium for batteries needed to power civilian and military aircraft, as well as hybrid electric cars.[170]

To meet its current demands for freshwater, China has embarked on a massive civil engineering project, known as the South-North Water Transfer Project, to move forty-five billion cubic meters of freshwater from the southern regions of the country, where the majority of the precipitation and groundwater is concentrated, to the arid regions in the north where the majority of its population, industry, and urban centers are located.[171] However, as the upper riparian state of freshwater flows emanating from the Tibetan Plateau, China's water diversion programs are effecting both the quantity and quality of freshwater available to several lower riparian nations including India, as well as the peoples of Cambodia, India, Myanmar (Burma), Pakistan, Thailand, and Vietnam, who are all heavily dependent upon fresh water sources originating in China.[172] China's control of the Tibetan Plateau, combined with its large-scale engineering projects has enabled it to become a hydro-hegemon, which will enable it to effectively turn freshwater into a potential political weapon.[173]

China can choose one or any combination of four actions including: (1) Regional Realism—China uses freshwater as a source of power to obtain favorable outcomes; (2) Global Realism—China takes advantage of new water desalination and water purification techniques to satisfy its own freshwater needs (self-help), without taking the concerns of other riparian nations into account, unless it is in its own interests to do so; (3) Regional Liberal Institutionalism—

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[170] Ibid., 109.

[171] Britt Crow, "China's South-North Water Transfer Project: A Means to a Political End," *State of the Planet Blog,* March 5, 2012, accessed March 20, 2014, http://blogs.ei.columbia.edu/2012/03/05/china%E2%80%99s-south-north-water-transfer-project-a-means-to-a-political-end/.

[172] NIC, *Water Choices in China: Challenges and Opportunities Through 2040,* 25.

[173] Chellaney, *Water, Peace, and War. Confronting the Global Water Crisis*, 230.

China agrees to negotiate formal treaties with other nations to ensure they have access to sufficient quantities of freshwater to meet their domestic needs. In effect, this would limit some of China's sovereignty regarding freshwater options that could impact its own diplomatic, economic, and military power; and (4) Global Liberal Institutionalism—China could, on a global scale, participate in virtual freshwater trading system whereby, freshwater is traded like other commodities in the same way that oil currently is, which could also lower political tensions.

To mitigate interstate conflicts between China and riparian neighbors regarding freshwater flows emanating from the Tibetan Plateau, there are a number of important steps that the United States could take which primarily involve a policy of Engagement. These include: (1) treating shared freshwater resources as part of a comprehensive effort to promote peace, stability, and environmental security, with watershed management being high priority to achieve unmistakably defined objectives;[174] (2) strengthening existing transboundary water management organizations, such as the APWF or establishing new ones through the UN;[175] (3) providing technical assistance on water resource management techniques including technical collection capabilities, environmental impact studies, water desalinization and reclamation technologies, advanced irrigation systems, as well as, hydrological data to China and its riparian neighbors to facilitate confidence building measures and to help ensure compliance of formal treaties;[176] (4) leveraging corporate influence through various multinational corporations that do business with China and its riparian neighbors to initiate policies that promote freshwater efficiency and sustainability into their business models;[177] and (5) the United States must be sensitive to China's

[174] NIC, *Water Choices in China: Challenges and Opportunities Through 2040,* 32.

[175] Ibid.

[176] Ibid.

[177] Ibid.

national interests when engaging in water resources issues, to carefully use its diplomatic, informational, economic and military sources of power to solicit Chinese cooperation.[178]

[178] Ibid., 31.

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